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ABSTRACT

Researchers have demonstrated that differences exist in the planning and interactive decision making tendencies of expert and novice teachers. This study investigated whether such differences exist between more experienced preservice teachers (n=6) and less experienced preservice teachers (n=6). Each teacher planned, taught, and reviewed two 30-minute lacrosse lessons in physical education. Data were obtained from the audiotapes of the planning and review sessions. While planning, the more experienced preservice teachers made a greater number of information requests and content decisions than the less experienced preservice teachers, but not process decisions. During instruction, the more experienced teachers made lesson adjustments when things were perceived as not going well. In contrast, the less experienced teachers continued to teach without making adjustments when things were perceived as not going well. These differences suggest that the more experienced preservice teachers have better developed knowledge structures with which to make sense of the teaching environment. (Author)

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Preactive and Interactive Decisions of Experienced and Inexperienced Novice Teachers

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Abstract

Researchers have demonstrated that differences exist in the planning and interactive decision making tendencies of expert and novice teachers. This study investigated whether such differences exist between more experienced preservice teachers (n=6) and less experienced preservice teachers (n=6). Each teacher planned, taught, and reviewed two 30-minute lacrosse lessons in physical education. Data were obtained from the audiotapes of the planning and review sessions. While planning, the more experienced preservice teachers made a greater number of information requests and content decisions than the less experienced preservice teachers, but not process decisions. During instruction, the more experienced teachers made lesson adjustments when things were perceived as not going well. In contrast, the less experienced teachers continued to teach without making adjustments when things were perceived as not going well. These differences suggest that the more experienced preservice teachers have better developed knowledge structures with which to make sense of the teaching environment.

Preactive and Interactive Decisions of Experienced and Inexperienced Preservice Teachers

In the past decade much has been learned about the cognitions of expert teachers. Research on teaching has provided the educational community with some insights into teachers' knowledge and thoughts which, in turn, has provided us with insights into the process of learning to teach. One of the most common ways to study pedagogical expertise has been to compare the performances of novice and expert teachers. This technique, which has been used in cognitive psychology for more than 20 years, has only recently been employed in research on teaching. The study described in this paper draws upon this technique, but not in the traditional manner. In this study, the teaching performance of more and less experienced and preservice teachers is contrasted.

To become "experts on expertise," cognitive psychologists have been contrasting the performance of novices and experts in a wide range of subject domains. To be an expert in a subject domain means to know more (Chase & Simon, 1973). In the context of memory models, knowing more means having more nodes (concepts) in memory and more relations among nodes, and thus higher capabilities for retrieving related nodes (Anderson, 1976; Collins & Quilliam, 1969). In simpler terms, those who know more are better able to remember information, recognize patterns, and link concepts in their area of expertise than are those who know less.

The notion of an expert possessing a dense semantic memory network has been demonstrated in several studies of chess players.

deGroot (1966) found that expert chess players could recall specific board positions far more accurately and quickly than novices. Chase and Simon (1973) showed that expert chess players could extract more information from a briefly exposed board configuration than novice chess players. The results from these studies indicate that an expert is better able to encode and utilize information than a novice. Similar findings were reported by Chi, Feltovich, and Glaser (1982) in physics. Expert physicists categorized physics problems into types according to the major principle used in the solution, while novice physicists categorized them into types according to the surface structures of the problem. In medicine, expert physicians were better able to interpret and diagnose diseases than novice physicians (Feltovich,1981). These findings suggest that experts have more robust relations among concepts in memory than novices.

Findings from research on problem solving indicate that experts are better able to assemble their existing relevant knowledge into higher order strategies than novices. In a recall task of computer programming language, McKeithen (1979) showed that both expert and novice programmers imposed some hierarchical organization on the materials which aided in recall. More importantly, however, the experts' written representations showed evidence of being based on programming relationships such as data type, whereas the novices used common language sequences to organize the same knowledge.

The research in cognitive psychology indicates that the ways in which expert and novice cognitions differ are consistent. Based on these studies, it seems that experts are better able than novices to recall relevant information, recognize meaningful situations and

patterns, and organize their existing relevant knowledge than novices.

The more recently completed research comparing expert and novice pedagogues suggests that characteristics of expertise in other cognitive domains also apply to teaching. The research indicates that expert teachers view classroom events differently, employ instructional and managerial routines more often and more effectively, make more informed planning decisions, and can recognize and rectify problem situations during interactive teaching more readily than novice teachers. Carter, Cushing, Sabers, Stein, and Berliner (1988) found that novice teachers described classroom events according to their surface structures while expert teachers made deep inferences about the same classroom events. For example, in viewing a slide of a classroom scene, one novice saw "a room full of students sitting at tables" (p. 27). In contrast, an expert viewed the same slide and said: "It's a hands-on activity of some type. Group work with a male and female of maybe late junior high school age" (p. 27). The results from a similar study (Berliner, 1985) indicate that expert teachers understand and explain classroom phenomena more precisely than novice teachers and ignore irrelevant classroom stimuli while keying in on the relevant. These findings are consistent with those from expert and novice chess players (Chase & Simon, 1973).

Leinhardt and Greeno (1986) and Leinhardt, Weidman, and Hammond (1987) examined teachers' classroom routines to explain differences between expert and novice teachers' knowledge structures. Routines are particular types of action schema, "namely,

scripted, low level elements of cooperative behaviors" (Leinhardt & Greeno, 1986, p. 83) that allow simple classroom activities to be carried out quickly and efficiently. Expert teachers were found to possess a large repertoire of routines, often with several forms of each one. Their routines were flexible, required little monitoring, and needed little explanation. In contrast, the researchers found an absence of routines in novice teachers' lessons which resulted in a greater amount of time spent explaining to students their roles and expectations.

The decision making processes employed by expert and novice teachers during planning and teaching differ as well. Expert teachers request more information and subsequently make a greater number of informed decisions during planning than novice teachers (Housner & Griffey, 1985; Taheri, 1982). In addition, expert teachers are better at anticipating critical moments in a lesson and creating contingency plans for these situations (Housner & Griffey, 1985; Sherman, 1983).

Expert and novice teachers also exhibit different decision making tendencies during interactive teaching. When expert teachers perceive problems during interactive teaching, they tend to act on them by making immediate in-flight adjustments (Taheri, 1982). In contrast, novice teachers tend not to know if things are going well and, consequently, make few lesson adjustments (Sherman, 1983; Taheri, 1982). These results suggest that expert teachers act upon incoming information to make immediate and sometimes future decisions, while novice teacher, who seem

uncertain of what to observe in the interactive environment, appear unable or unwilling to make in-flight decisions.

Research on teachers' thinking indicates that novices possess insufficient knowledge to adopt the views and routines of experts and insufficient knowledge to make the decisions that experts routinely make during preactive and interactive teaching. Now that we know expert and novice teachers' knowledge structures differ, we must begin to understand just how it is that a novice teacher learns to think and act like an expert. One cannot assume that what an expert knows and does can be given to a novice, and then the novice too will become an expert. Clark and Peterson (1986) suggest that researchers study teachers' acquisition of skills as they move along the expert/novice continuum, so that the development of expertise can be examined. In the study described herein, the planning and interactive teaching decisions of more and less experienced preservice teachers (novice teachers) were compared.

Method

Subjects

Participants were 12 preservice teachers, all of whom were teacher education majors in physical education at the same urban university. At the time of the study, six of the participants were beginning their third year in the four year program (less experienced novices) and six were completing their fourth year (more experienced novices). The more experienced novices had completed two public school prestudent teaching practica and the student teaching experience prior to the study, while the less experienced

novices had yet to complete a school-based field experience. In addition, the more experienced preservice teachers had completed two specialized pedagogical methods courses that the less experienced preservice teachers had yet to complete. Each group consisted of five males and one female. The more experienced participants were selected from a pool of 15 subjects and the less experienced from a pool of 15 subjects. Mean ages for the two groups were 26 (more experienced) and 22 years (less experienced).

Data Collection

Each preservice teacher planned, taught, and reviewed two 30-minute physical education lessons in lacrosse on two consecutive days. One of four lacrosse skills (carrying, scooping, throwing, or catching) was randomly assigned to each teacher for instruction. The lessons were taught to intact classes of 14 to 17 learners, aged eight and nine years. The teachers were allocated 90 minutes to plan each lesson. They were informed that a videotape of the skill to be taught was available for viewing and that the objective of the lesson was to increase their students' ability to perform the skill. Any other information that the participants required during planning was provided only upon request. The investigator had a prepared list of answers to questions that were anticipated from the participants. The subjects were instructed to think aloud while planning, and their verbalizations were recorded on audiotape. Immediately after each planning session, the teachers taught the lessons in the university elementary school gymnasium.

Following each lesson, the participants viewed six two-minute video segments of their teaching and responded to a series of

structured interview questions to stimulate recall of decisions made during interactive teaching. After viewing each segment, the participants responded to a sequenced set of questions: (1) What was happening during this segment? (2) What were you thinking about? (3) Was the lesson proceeding as planned? (4) If not, was a new routine necessary? (5) Did you have one in mind? and (6) Did you implement a new routine? The stimulated recall sessions, each of which were audiotaped, lasted between 30 and 60 minutes.

Data Analysis

Planning.

The transcriptions from the think aloud and stimulated recall sessions provided the basic data. Information requests and decisions were identified from the planning protocols. Information requests were defined as statements or questions made to elicit information about the lesson, while planning decisions were defined as statements made to show that a specific course of action for the lesson had been selected.

The procedures used to analyze the planning protocols were designed to ensure systematic, reliable coding of participants' planning statements. As a first step, a coding form was developed with categories derived from an initial reading of the protocols for two subjects. The coding form consisted of two major sets of categories: information requests and decisions.

In the second step of the analysis, the planning protocols of all 12 subjects were coded by two coders for information requests and decision statements. Intercoder agreement at this level of analysis was .89 (Hawkins & Dodson, 1975). During the third step, the

information requests and decision statements from two subjects were categorized according to commonalities. The two coders categorized the information requests and decision statements together during this step to arrive at consensus for category descriptors. The remaining protocols were independently coded and then compared to record agreements and disagreements. Intercoder agreement at this level of analysis was .80. While analyzing the planning protocols, the coders also kept a record of when the participants made information requests.

Three information request categories emerged as a result of the data reduction technique employed. Questions and statements pertaining to learner characteristics were labelled student information requests, those pertaining to equipment, facilities, and materials as resource requests, and those pertaining to subject matter as content requests.

The planning statements were categorized as content or process decisions. Statements made about what to teach were labelled content planning decisions, while statements made about how to teach were labelled process planning decisions. Content decisions were further categorized into three groups: (1) task structure decisions, statements made about the general types of activities to be employed; (2) task procedure decisions, statements made about the procedural details identified for the performance of the activities; and (3) task formation decisions, statements made about the spatial organization of the activities. Process decisions were further categorized into two groups: (1) instructional strategy decisions, statements made about task presentations and teaching

styles; and (2) management decisions, statements made about lesson transitions, equipment, and class rules.

Category frequency scores were calculated for each lesson and descriptive statistics obtained. Multivariate two-way analyses of variance (groups x lessons) were used to determine group planning differences. A .05 level of significance was employed in all analyses.

Interactive.

The decision pathways taken during interactive teaching were identified from the stimulated recall protocols. An interactive decision model, which was originally conceived by Snow (1972) and Shavelson and Stern (1981) and later used by Sherman (1983), was employed to categorize teachers' decisions into five pathways based on their responses to post-lesson interview questions. Pathways 1 to 4 reflected decisions to continue planned teaching routines unchanged. A Path 1 decision meant that the teacher perceived things as going well. A Path 2 decision meant that the teacher perceived things as going poorly, but not poorly enough to consider an adjustment necessary. A Path 3 decision meant that the teacher perceived things as going poorly enough to consider an adjustment necessary, but did not know what to do. A Path 4 decision meant that the teacher had an alternative plan or adjustment in mind, but did not implement it. Taking Path 5 reflected the decision to alter the lesson from the planned routine.

The post-lesson protocols were analyzed by two trained coders. Intercoder agreement was calculated using the scored-interval

method (Hawkins & Dodson, 1975). A coefficient of .86 was obtained.

Frequency scores were calculated for the five different decision pathways. A multivariate two-way analysis of variance (groups x lessons) was conducted to determine group differences in decision pathways taken. A .05 level of significance was employed.

Results

Planning Data

During planning, the more experienced novices made significantly more information requests, $F(3,8)=6.34$, $p<.05$, and content planning decisions, $F(3,8)=7.94$, $p<.05$, than the less experienced novices, but not process planning decisions, $F(2,9)=1.69$, $p>.05$. On average, the more experienced preservice teachers made 9.4 information requests per lesson, while the less experienced novices made 5.0 requests. The more experienced preservice teachers made more information requests per lesson across all categories than the less experienced preservice teachers (see Figure 1).

Place Figure 1 About Here

In terms of content planning decisions, the more experienced novices averaged 13.8 decisions per lesson, while the less experienced novices averaged 8.1 (see Figure 2). The more experienced novices made 4.4 task structure, 7.4 task procedure, and 2.0 task formation decisions per lesson, while the less experienced

novices made 3.0 task structure, 3.8 task procedure, and 1.3 task formation decisions per lesson.

Place Figure 2 About Here

For process planning decisions, the more experienced novices averaged 9.0 per lesson, while the less experienced novices averaged 6.5 per lesson (see Figure 3). The more experienced novices made 5.6 instructional and 3.4 management decisions per lesson, while the less experienced novices made 4.5 and 2.0 per lesson, respectively.

Place Figures 3 About Here

Two distinct patterns of lesson planning emerged from the data. The more experienced novices made the majority of their information requests at the beginning of each planning session, prior to making any planning decisions. In contrast, the less experienced novices made as many information requests during and at the end of each planning session as at the beginning.

Interactive Data

A significant group difference was revealed for decision paths taken during interactive teaching, $F(5,6)=7.36$, $p<.05$. The results indicated that the more experienced novices made decisions to teach as planned more frequently (2.7)than the less experienced novices. The results showed that when things were perceived as not going well, the more experienced novices made lesson adjustments (Path 5) whereas the less experienced novices either considered an

adjustment unnecessary or had no adjustment plan available. Group mean scores for the five decision paths are presented in Figure 4.

Place Figure 4 About Here

Discussion

The findings from expert/novice studies of teaching have provided teacher educators with considerable information about differences in teachers' planning, interactive decision making, and pedagogical content knowledge. The results of this study indicate that more and less experienced novice teachers differ considerably in the decision making strategies they employ as they plan for and teach lacrosse lessons in physical education. More experienced novices tended to make more information requests and more decisions about what to teach than less experienced novices when planning lessons, but no more decisions than the less experienced about how to teach. In addition, more experienced novices tended to plan lessons more systematically than less experienced novices. More experienced novices gathered information about who, when, and where they were to teach before deciding upon what and how to teach. Less experienced novices, on the other hand, tended to make decisions first and ask questions later.

Presented in Figures 5 and 6 are planning concept networks (maps) of one more and one less experienced preservice teacher's diagnostic knowledge base, respectively. These maps illustrate the marked differences between the preactive thoughts of more and less

experienced novice teachers. The more experienced novice requested information about student characteristics, facilities, materials, and equipment, and content related materials. In contrast, the less experienced novice asked about materials that could be used in the teaching environment and content related materials, but not about the characteristics of their students. The data suggest that the more experienced novice knew more than the less experienced novice about what one needs to know before planning a lesson. From a theoretical prospective, the maps suggest that the more experienced novice possessed a richer knowledge structure of teaching than the less experienced novice. This result is consistent with previous research in physical education (Housner & Griffey, 1985; Taheri, 1982), where teachers-in-training made fewer planning information requests than experienced teachers, as well as with expert/novice findings on the running of classrooms (Berliner, 1985; Carter, Sabers, Cushing, Pinnegar, & Berliner, 1987).

Place Figures 5 and 6 About Here

The planning maps also show that the decision making processes of the more experienced preservice teacher were more complex than those of the less experienced preservice teacher. The less experienced novice made content decisions about the general types of tasks and the procedural details regarding the performance of the tasks, while the more experienced novice made these same decisions plus others about class organization, time allocation, and special situations. In terms of process decisions, the less

experienced novice made decisions about teaching styles, skill demonstrations, and skill focus. The more experienced novice made these same decisions plus others involving equipment usage, student assessment, student management, and verbal instruction. These results are also consistent with previous findings findings where teachers-in-training made fewer and different types of planning decisions than experienced teachers (Housner & Griffey, 1985; Taheri, 1982).

The interactive decision pathway analysis revealed significant group differences as well. When preservice teachers perceived their lessons not progressing as planned, the less experienced novices continued to teach without deviating from their planned routines, while the more experienced novices made changes to resolve their difficulties. This suggests that the more experienced novices had a greater number of alternative teaching routines in long term memory than the less experienced novices, and that they were better able to implement these routines when necessary. Leinhardt and Greeno (1986) found that expert math teachers had a larger repertoire of teaching routines stored in memory than novice math teachers and that the experts were able to implement new routines more readily and with less effort than the novices. The interactive decision making tendencies of the more experienced preservice teachers in this study seemed more like the expert math teachers in Leinhardt and Greeno's (1986) study, while the decision making tendencies of the less experienced novices seemed more like the novice math teachers.

Within the limitations of this study, the following two conclusions can be drawn about the planning and interactive cognitions of more and less experienced preservice teachers. First, more and less experienced preservice teachers plan differently. More experienced preservice teachers are more inquisitive, decisive, and deliberate. Second, more experienced preservice teachers tend to follow their planned routines while teaching when they perceive things to be going well, and make lesson adjustments when they perceive things not going well. In contrast, less experienced novices tend to follow their planned routines no matter what is happening in the classroom.

Implications

Clearly preservice teachers who have had specialized method and field experiences plan and teach differently than those who have not. The planning data seem to suggest that less experienced novices would benefit from an instructional unit on lesson planning that directs their planning search to relevant aspects of the learning environment. One might hypothesize that less experienced preservice teachers would make more information requests and, in turn, informed planning decisions when instructed to focus on the critical elements (learners, resources, and content) of the teaching environment.

The interactive data suggest that less experienced novices need diagnostic training in recognizing when things are going well and when things are not going well. In addition, they need training in alternative teaching strategies to make adjustments when things

are not going well. The data also suggest that the complexity of the interactive environment needs to be limited while learning to teach. A series of field experiences with limits imposed on factors like class size, learner age, and familiarity with subject matter would likely benefit "novice" novices.

Finally, this study contributes to further research by demonstrating that different degrees of noviceness exist within the novice stage. This may have implications for selecting novice subjects in the future.

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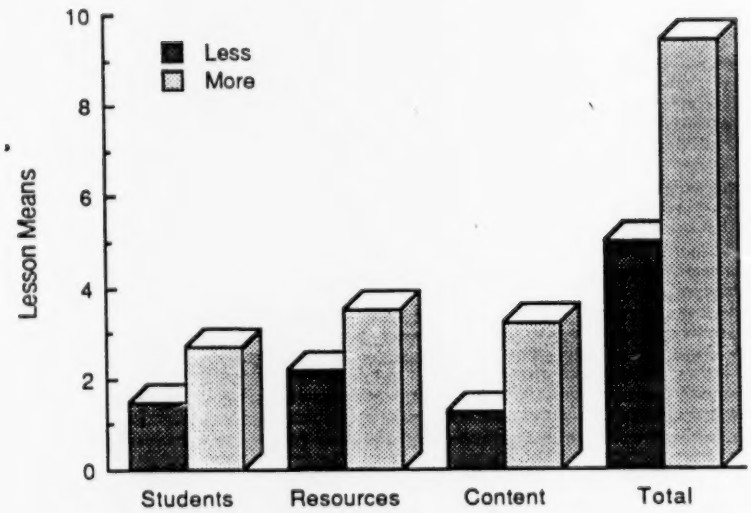

Figure 1. Lesson means for information cue request categories.

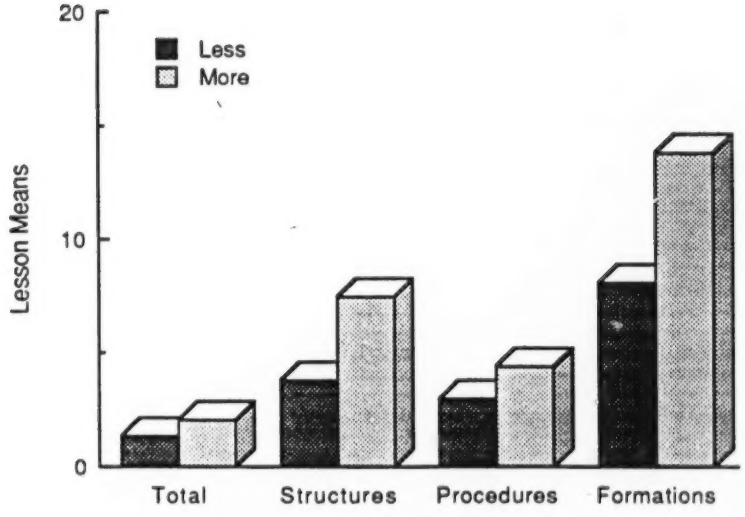

Figure 2. Lesson means for content decision categories.

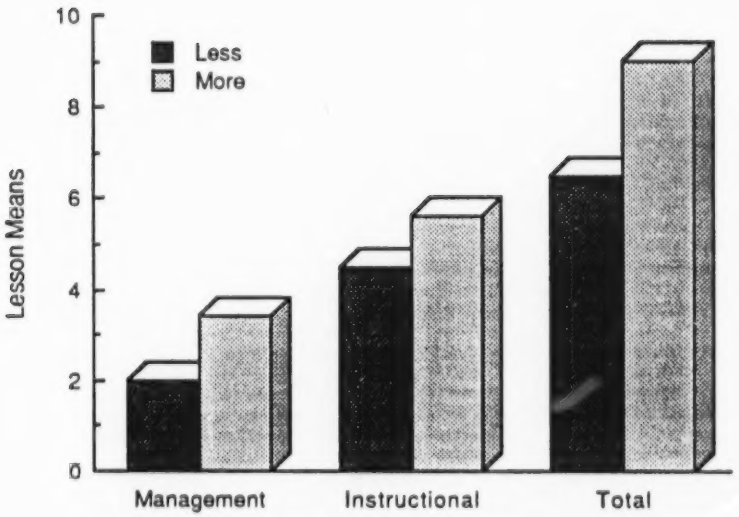

Figure 3. Lesson means for process decision categories.

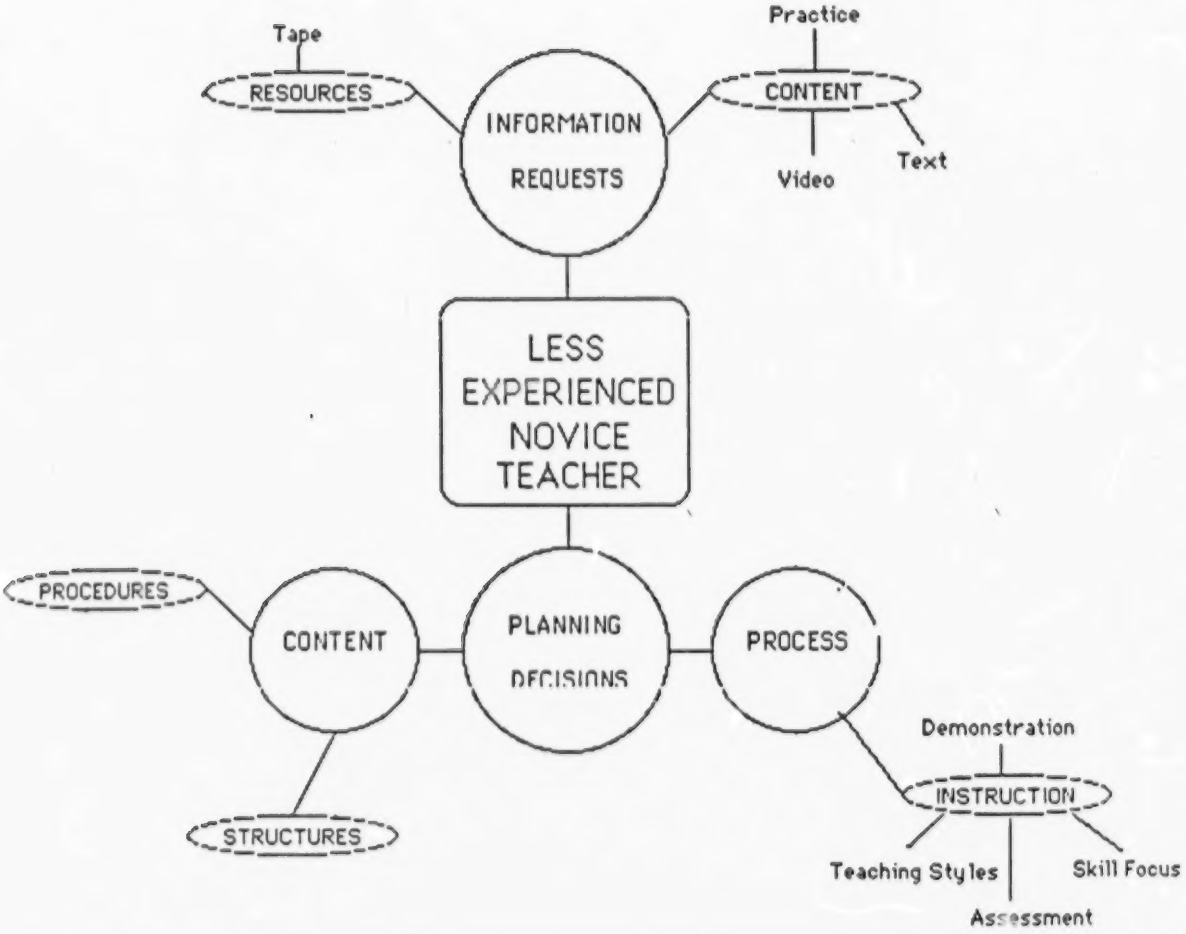

Figure 5. Planning concept map of a less experienced novice teacher.

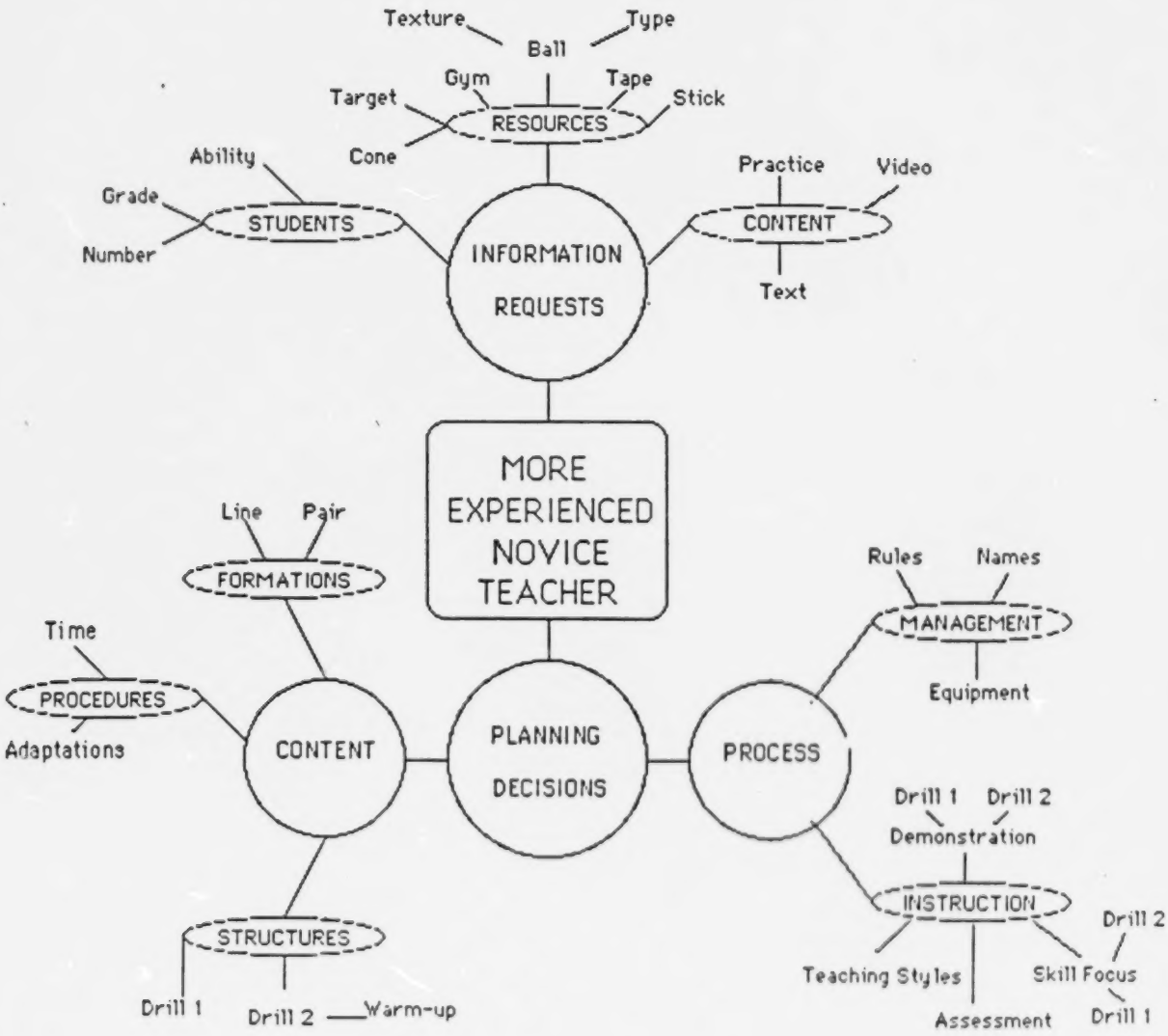

Figure 6. Planning concept map of a more experienced novice teacher.